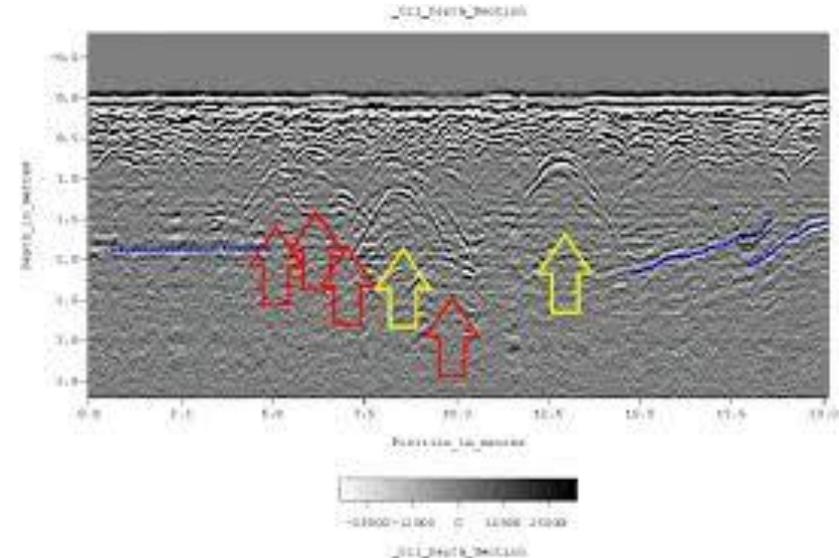


Geospatial Technologies for Preventing Excavation Damage

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Existing Damage Prevention Technologies

- Electromagnetic locators
- Acoustic locators
- Ground penetrating radar
- RFID marker balls
- GPS mapping
- GPS-enabled locators



Example

- Mobile GIS on tablet computers with high accuracy GPS and barcode scanning for mapping new installations
- Increases mapping and locate accuracy
- Eliminates mapping backlogs

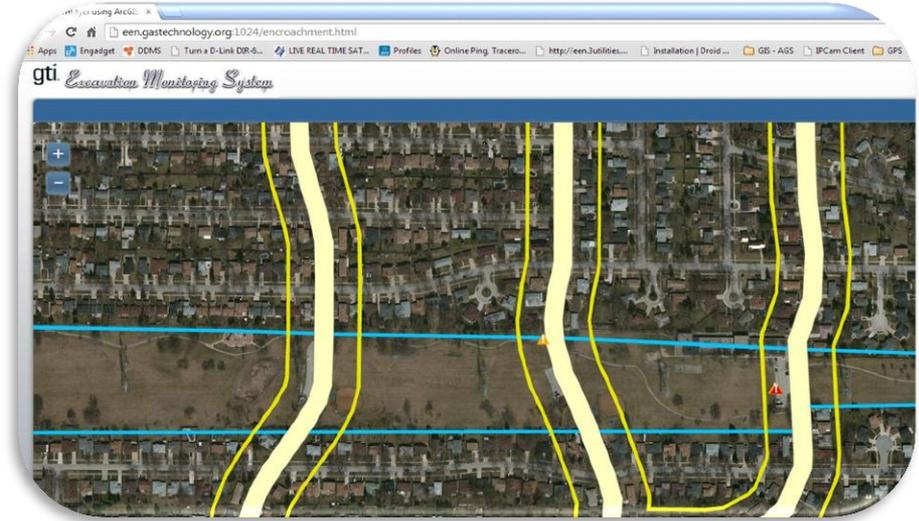


Emerging Damage Prevention Technologies

- Aerial-based monitoring
- Locatable warning tape/rope
- GPS-based excavation monitoring

Example

- GPS-enabled smart phones mounted on equipment tracks excavation activity
- Geospatial software compares excavation activity to the location of underground pipes in an operator's GIS
- Analysis software determines if an encroachment is occurring
- Notification software sends email/text/phone warning
- Pilot projects in New York, California, and Texas in 2014 and 2015



Technology Gaps

GPS Locating

- Technology is available, but not being used
 - High accuracy GPS is expensive
 - High accuracy GPS is complex and requires training
 - Need to get data into GIS efficiently
 - GPS-enabled locating would require a new workflow including access to GIS data

Need: GPS-enabled locators that are reasonably priced, can be used by the existing workforce, and can seamlessly integrate with GIS

GPS Excavation Monitoring

- Prototype technology is developed and being tested in multiple pilot projects
- Low-cost smartphones and advanced GIS
- Integration with one-call centers
- Business model
- Incentives for adoption

Need: Final commercialization phase to promote industry adoption of GPS excavation monitoring technology

Existing Asset Map Correcting

- Geospatial technologies for mapping new installations may not be feasible for mapping existing assets
- In-pipe inertial mapping
- Integration with ILI tools
- Better methods for GIS integration

Need: Technology to cost-effectively map existing assets as part of routine O&M and methods to seamlessly get data into GIS

Trenchless

- Limited tools to locate underground assets during trenchless installations

Need: Technology to locate underground assets during trenchless installations

Tracer Wire

- Tracer wire is susceptible to corrosion and breakage
- Robust tracer wire
- “Smart” tracer wire
 - 3M’s RF warning tape and rope

Need: Alternatives to traditional tracer wire that withstands normal operations and incorporate “smart” technologies

Gaps

- GPS-enabled locators that are reasonably priced, can be used by the existing workforce, and can seamlessly integrate with GIS
- Final commercialization phase to promote industry adoption of GPS excavation monitoring technology
- Technology to cost-effectively map existing assets as part of routine O&M and methods to seamlessly get data into GIS
- Technology to locate underground assets during trenchless installations
- Alternatives to traditional tracer wire that withstand normal operations and incorporate “smart” technologies